Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

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The spread of SARS-CoV-2 in Spain: Hygiene habits, sociodemographic profile, mobility patterns and comorbidities

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ABSTRACT

COVID-19 constitutes the largest pandemic in the last 100 years. In view of the rapid spread of the virus, it is necessary to study the sociodemographic characteristics, hygiene habits, activity and mobility, and comorbidities of SARS-CoV-2 infection to be able to implement prevention strategies. For this purpose, a survey including the variables of interest was designed to try to understand the exponential spread of the virus despite the implemented severe restrictive mobility measures during the period of maximum confinement in Spain. This study conducted throughout the Spanish territory aims to clarify other routes of transmission of the COVID-19 during confinement, risk factors, and the effectiveness of the recommended hygiene measures to detect critical points of exposure to the virus and thus reduce its spread in this and possible future pandemics that could compromise public health.

Our results show that living with a COVID-19 patient increased the risk of contagion by 60 times. Among all the sociodemographic variables analyzed, walking the dog have shown to have the strongest effect by increasing the risk by 78%. The most effective hygiene measure reducing the prevalence of the disease was the disinfection of products purchased from the market upon arrival home (which reduced the risk by 94%), above other hygiene measures, such as wearing masks, gloves, ethanol disinfection, bleaching and others. The mobility variable studied that showed the largest increase in the prevalence of the disease was working on site at the workplace (increased the risk by 76%). A significant higher prevalence of the disease was also detected among respondents who used the modality of acquiring basic commodities using home delivery service compared to those who chose in-store shopping.

1. Introduction

COVID-19, the worst pandemic in 100 years, has spread across the globe. The virus has infected more than 7 million people and it has caused over 400,000 deaths up to June 2020 (https://www.who.int/emergencies/diseases/novel-coronavirus-2019/situation-reports/), being reported in approximately 200 countries and territories (Yuki et al., 2020). Cases of the novel coronavirus SARS-CoV-2 were first reported in Wuhan, Hubei province, China, in December 2019. Numerous ongoing studies are trying to clarify the prevalence and severity of the disease in the different population groups, based on variables, such as age, sex, comorbidities, and lifestyle habits, finding that elderly people and patients with previous diseases, such as lung diseases, heart diseases, diabetes, and cancer, have the higher risk (Ali and Alharbi, 2020).

Symptoms of patients infected with SARS-CoV-2 ranges from

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minimal symptoms to severe respiratory failure with multiple organ failure (Yuki et al., 2020). Coronaviruses infect the upper gastrointestinal and respiratory tract among others, causing a series of respiratory disturbances, including severe respiratory syndrome. Angiotensin Converting Enzyme-2 receptors play a pivotal role in the pathogenesis of the virus. Disruption of this receptor also leads to cardiomyopathy, cardiac dysfunction, and heart failure (Long et al., 2020). In addition to respiratory symptoms, thrombosis and pulmonary embolism have been observed in critically ill COVID-19 patients. Neurological symptoms have been reported in patients affected by COVID-19, such as headache, dizziness, myalgia and anosmia, as well as cases of encephalopathy, encephalitis, necrotizing hemorrhagic encephalopathy, stroke, epileptic seizures, rhabdomyolysis and Guillain-Barré syndrome, associated with SARS-CoV-2 infection (Filatov et al., 2020). Nearly 20% of patients had abnormal coagulation function, and most of severe and critically ill patients presented coagulation disorders and had the tendency to develop into disseminated intravascular coagulation (Giannis et al., 2020). Patients, especially children, has also shown gastrointestinal symptoms, such as nausea, vomiting, and diarrhea (Zhou et al., 2020).

However, viral target cells and organs have not been fully determined, hindering our understanding of the pathogenesis of the viral infection and viral transmission routes. Epidemiological studies have indicated person-to-person transmission, which includes direct transmission, such as cough, sneeze, droplet inhalation transmission, and contact transmission, such as the contact with oral, nasal, and eye mucous membranes (Chan et al., 2020; Otter et al., 2016). Other transmission routes are under investigation, such as airborne spread due to air particulate matter, semen, urine and fecal-oral transmission (Cardona Maya et al., 2020; Paoli et al., 2020; Wang and Xu, 2020). SARS-CoV-2 has been detected in untreated wastewater (Ahmed et al., 2020). According to a recently published case report, SARS-CoV-2 RNA was detected in a stool specimen, raising the question of viral gastrointestinal infection and a fecal-oral transmission route (Xiao et al., 2020). Significant environmental contamination by patients carrying SARS-CoV-2 through respiratory droplets and fecal shedding suggests that the environment serves as a potential medium of transmission and supports the requirement for strict adherence to environmental and hand hygiene (Ong et al., 2020).

Epidemiological studies are needed during emerging epidemics to best monitor and anticipate spread of infection. In view of the rapid spread of the virus, it becomes necessary to study the lifestyle habits, sociodemographic characteristics and comorbidities of SARS-CoV-2 infection to be able to implement prevention strategies. The understanding of these concepts would contribute to halting the spread of the virus in this and future possible events that could compromise public health.

Spain is one of the countries in the world most affected by the spread of the virus. The present study performed throughout the Spanish territory sought to clarify the main causes of transmission of the COVID-19 disease during confinement and some risk factors, in order to detect the critical points of exposure to the virus and thus reduce its spread.

2. Methodology

2.1. The survey

The survey (see supplementary material) was designed to collect information regarding possible routes of exposure to SARS-CoV-2 during confinement in Spain and some risk factors.

It was indicated that the responses to the survey would be relative to the period corresponding to the phase of maximum mobility restriction in Spain, during the state of alarm decreed in Spain (RD 463/2020, March 14, 2020), when presential work activity was restricted to only basic services and essential activities (healthcare, security forces, civil protection, rescue, firefighting, roadside assistance, road maintenance, urban solid waste collection, fuel transportation, production, food retailers, transformation and distribution of agricultural products, livestock and fishery products, production, distribution, rental and repair of equipment and machinery for agriculture, fishing, animal husbandry, and its associated industry, and to the transport and treatment of agricultural, livestock and fishing residues and by-products, food industry, manufacture and distribution of cleaning and hygiene products, postal services, funeral services, private security, assistance and care for the elderly, minors, dependents, people with disabilities or especially vulnerable people, financial and insurance entities). The information asked for and included in the survey attempted to collect all the few activities that were allowed for the Spanish population during the stage of maximum confinement in the state of alarm decreed in Spain, in addition to sociodemographic features and health habits and other characteristics that could be relevant to try to establish which of these concepts could be a critical point to contract the disease.

The survey was designed in Google Docs platform (see Tables 1–4 or supplementary material) and distributed via email by mailing lists of the University of Granada, social networks and mobile phone devices. The surveys were collected from April 4th to May 5th, 2020.

2.2. Outcome variable

The main outcome variable was the condition of COVID-19 case. This question was formulated as “Have you suffered the COVID-19 disease?“, which was coded into 4 categories: Yes, I suspect yes, No, I don’t know.

2.3. Predictors

We included 41 questions related to 6 dimensions: sociodemographic characteristics (sex, age, educational level), home characteristics (type of residence, cohabiting people, housemaids working at home), pets (kind of pet and walking habits), work activity (working on-site during the confinement, work space), protection (use of mask, gloves, hydroalcoholic gel, disinfectant products, laundry), mobility (using public transportation, visit to supermarket, pharmacy, tobacco shop, bank, medical care center, home delivery), other diseases or health conditions (smoker, previous diseases, overweight or obesity, pharmacological treatment, physical activity).

2.4. Statistical analysis

The results of the surveys were centralized and conveniently categorized for subsequent statistical analysis using SPSS statistical package v25 (IBM Corp. 2017. Armonk, NY).

The tables have grouped the variables according to the dimension they measure, and the distribution of the sample on the response categories of each variable is shown in the same table, along with the estimated prevalence of COVID-19 according to these characteristics. Differences in estimated prevalence were compared using the Chi-square test or Fisher’s exact test (depending on compliance with the application conditions of the first one).

Considering that the capacity of diagnostic tests in Spain was not sufficient, two affirmative categories were introduced. One of them was affirmative by diagnosis and the other by patient self-report. Regarding the COVID-19, the response categories of “yes” have been combined with that of “I suspect yes”. Surveys in which the response was “no” or “I do not know” have been considered negative.

The covariates most correlated with the risk of COVID-19 were identified in a first approach using an elastic net model with cross-validation. Then a multivariate logistic regression model for COVID-19 was adjusted including the variables identified by the elastic net model and those other variables that had a p-value below 0.2 in the bivariate analysis. Finally, variables from the Wald test with p-values above 0.1 in the multivariate analysis were removed. Odds Ratio and 95% confidence intervals were extracted from this final model. This analysis was performed with Stata statistical package v16 (StataCorp LP.

Table 1
Sample distribution and prevalence of COVID-19 according to sociodemographic variables.

		Total		COVID-19				
				Negative/I do not know		Positive/ suspicious		*p*-value
		n	% of total	n	%	n	%	
Total		2086	100.0%	1987	95.3%	99	4.7%	
Sex	Women	1393	66.8%	1324	95.0%	69	5.0%	
	Men	692	33.2%	662	95.7%	30	4.3%	0.306
Age group	<40	660	31.6%	631	95.6%	29	4.4%	
	40–54	856	41.0%	806	94.2%	50	5.8%	
	≥55	570	27.3%	550	96.5%	20	3.5%	0.113
Educational level attained	Elementary/no studies	135	6.5%	131	97.0%	4	3.0%	
	High school	204	9.8%	197	96.6%	7	3.4%	
	Vocational training	169	8.1%	156	92.3%	13	7.7%	
	Graduate	661	31.7%	634	95.9%	27	4.1%	
	Postgraduate	917	44.0%	869	94.8%	48	5.2%	0.189
Residence type	Living alone	182	8.7%	171	94.0%	11	6.0%	
	Shared housing	317	15.2%	306	96.5%	11	3.5%	
	Family home	1502	72.0%	1429	95.1%	73	4.9%	
	Collective residence	85	4.1%	81	95.3%	4	4.7%	0.600
Number of people with whom you live	0	134	6.4%	127	94.8%	7	5.2%	
	1	378	18.1%	360	95.2%	18	4.8%	
	2	496	23.8%	479	96.6%	17	3.4%	
	3	555	26.6%	526	94.8%	29	5.2%	
	4 or more	523	25.1%	495	94.6%	28	5.4%	0.615
Do you live with children (0–13 years old)?	Yes	731	35.0%	695	95.1%	36	4.9%	
	No	1355	65.0%	1292	95.4%	63	4.6%	0.829
Do you live with adolescents (14–17 years old)?	Yes	450	21.6%	422	93.8%	28	6.2%	
	No	1636	78.4%	1565	95.7%	71	4.3%	0.104
Are there housemaids working at your house during the confinement?	Yes	90	4.3%	85	94.4%	5	5.6%	
	No	1987	95.7%	1895	95.4%	92	4.6%	0.609
Do you have pets?	None	1328	63.7%	1270	95.6%	58	4.4%	
	Dog	491	23.5%	459	93.5%	32	6.5%	
	Cat	145	7.0%	140	96.6%	5	3.4%	
	Others	100	4.8%	97	97.0%	3	3.0%	
	Not reported	22	1.1%	21	95.5%	1	4.5%	0.162
Do you have pets that you walked during the confinement?	Yes	407	19.5%	379	93.1%	28	6.9%	
	I do not have or I haven't taken my pet for a walk	19	80.5%	1608	95.8%	71	4.2%	0.024
Do you live with household members who have suffered COVID-19?	Yes	99	4.70%	34	41.00%	49	59.00%	0.001
	No	1987	95.30%	1953	97.50%	50	2.50%	

Table 2
Sample distribution and prevalence of COVID-19 according to hygiene habits.

		Total		COVID-19				
				Negative/I do not know		Positive/ suspicious		*p*-value
		n	% of total	n	%	n	%	
When going outside during the confinement, have you worn any face mask?	Yes. FFP2/FFP3 face mask	534	25.6%	513	96.1%	21	3.9%	
	Yes. surgical face mask	986	47.3%	930	94.3%	56	5.7%	
	No	382	18.3%	370	96.9%	12	3.1%	
	I have not gone outside	173	8.3%	163	94.2%	10	5.8%	
	Homemade face mask	11	0.5%	11	100.0%	0	0.0%	0.205
When going outside during the confinement, have you used gloves?	Yes	1367	65.5%	1303	95.3%	64	4.7%	
	No	548	26.3%	525	95.8%	23	4.2%	
	I have not gone outside	171	8.2%	159	93.0%	12	7.0%	0.313
Do you use hydroalcoholic gel to sanitize your hands at home?	Yes	1314	63.0%	1248	95.0%	66	5.0%	
	No	772	37.0%	739	95.7%	33	4.3%	0.458
Do you use bleach to disinfect the floor in your home?	Yes	1606	77.2%	1531	95.3%	75	4.7%	
	No	474	22.8%	451	95.1%	23	4.9%	0.902
Do you use bleach to disinfect doorknobs and other surfaces in your home?	Yes	1339	64.2%	1276	95.3%	63	4.7%	
	No	747	35.8%	711	95.2%	36	4.8%	0.915
Do you disinfect or isolate your footwear when you return from the street?	Yes	1396	67.0%	1337	95.8%	59	4.2%	
	No	546	26.2%	516	94.5%	30	5.5%	
	I have not gone outside	142	6.8%	134	94.4%	8	5.6%	0.427
Do you wash clothes every time you come back from the street?	Yes	786	37.8%	746	94.9%	40	5.1%	
	No	1149	55.3%	1100	95.7%	49	4.3%	
	I have not gone outside	144	6.9%	136	94.4%	8	5.6%	0.618
When you purchase anything, do you apply any disinfectant product on the products?	Yes	1416	67.9%	1362	96.2%	54	3.8%	
	No	670	32.1%	625	93.3%	45	6.7%	0.004

Table 3
Sample distribution and prevalence of COVID-19 according to mobility variables.

		Total		COVID-19				
				Negative/I do not know		Positive/ suspicious		*p*-value
		n	% of total	n	%	n	%	
Have you used public transportation during the confinement?	Yes	88	4.2%	78	88.6%	10	11.4%	
	No	1998	95.8%	1909	95.5%	89	4.5%	0.007
Bus	Yes	51	2.4%	46	90.2%	5	9.8%	
	No	2035	97.6%	1941	95.4%	94	4.6%	0.091
Taxi	Yes	27	1.3%	25	92.6%	2	7.4%	
	No	2059	98.7%	1962	95.3%	97	4.7%	0.370
Train	Yes	10	0.5%	8	80.0%	2	20.0%	
	No	2076	99.5%	1979	95.3%	97	4.7%	0.078
Metro	Yes	31	1.5%	27	87.1%	4	12.9%	
	No	2055	98.5%	1960	95.4%	95	4.6%	0.056
During confinement, have you been in the supermarket/greengrocery/butchery/bakery?	Yes	1695	81.8%	1619	95.5%	76	4.5%	
	No	377	18.2%	357	94.7%	20	5.3%	0.498
During confinement, have you been in the pharmacy?	Yes	1399	67.3%	1341	95.9%	58	4.1%	
	No	680	32.7%	641	94.3%	39	5.7%	0.120
During confinement, have you been in the tobacco shop?	Yes	400	19.3%	386	96.5%	14	3.5%	
	No	1675	80.7%	1592	95.0%	83	5.0%	0.238
During confinement, have you been in the bank?	Yes	427	20.6%	413	96.7%	14	3.3%	
	No	1646	79.4%	1563	95.0%	83	5.0%	0.156
During confinement, have you been in	Yes	284	19.2%	261	91.9%	23	8.1%	
a medical care center?	No	1196	80.8%	1122	93.8%	74	6.2%	0.285
How often has someone from your household left the home to purchase basic commodities (food, pharmaceuticals, press, etc.)	several times a day	8	0.4%	8	100.0%	0	0.0%	
	once a day	121	5.8%	117	96.7%	4	3.3%	
	every 2–3 days	415	19.9%	392	94.5%	23	5.5%	
	weekly	1187	56.9%	1131	95.3%	56	4.7%	
	others	355	17.0%	339	95.5%	16	4.5%	0.816
Have you ordered ready meals for home delivery?	Yes	403	19.3%	379	94.0%	24	6.0%	
	No	1683	80.7%	1608	95.5%	75	4.5%	0.239
Do you buy the essential commodities online (home delivery) or in-store?	In-store	1834	88.1%	1752	95.5%	82	4.5%	
	Home delivery	248	11.9%	231	93.1%	17	6.9%	0.110
Have you purchased other products through e-commerce?	Yes	1262	60.5%	1195	94.7%	67	5.3%	
	No	824	39.5%	792	96.1%	32	3.9%	0.141
Have you traveled abroad in the two weeks prior to the decree of the state of alarm?	Yes	130	6.2%	126	96.9%	4	3.1%	
	No	1956	93.8%	1861	95.1%	95	4.9%	0.407
Have you worked on-site during the confinement?	Yes	595	28.5%	557	93.6%	38	6.4%	
	No	1491	71.5%	1430	95.9%	61	4.1%	0.030
If the previous answer is yes, please indicate if the work activity has been performed in	Open area	50	8.0%	47	94.0%	3	6.0%	
	Enclosed space	573	92.0%	537	93.7%	36	6.3%	0.617
Do you live with someone who has traveled to the workplace during the confinement?	Yes	684	32.8%	651	95.2%	33	4.8%	
	No	1402	67.2%	1336	95.3%	66	4.7%	0.913
If the previous answer is yes, please indicate if the work activity has been performed in	Open area	116	16.3%	109	94.0%	7	6.0%	
	Enclosed space	594	83.7%	568	95.6%	26	4.4%	0.468

Table 4
Sample distribution and prevalence of COVID-19 according to comorbidity.

		Total		COVID-19				
				Negative/I do not know		Positive/suspicious		*p*-value
		n	% of total	n	%	n	%	
Do you smoke?	Yes	342	16.4%	330	96.5%	12	3.5%	
	No	1744	83.6%	1657	95.0%	87	5.0%	0.003
Have you got a disease diagnosed before the state of alarm?	Yes	517	25.0%	488	94.4%	29	5.6%	
	No	1548	75.0%	1480	95.6%	68	4.4%	0.280
Are you overweight?	Yes	479	23.1%	451	94.2%	28	5.8%	
	No	1592	76.9%	1523	95.7%	69	4.3%	0.175
Are you regularly under any pharmacological treatment prior to the state of alarm?	Yes	776	37.4%	746	96.1%	30	3.9%	
	No	1298	62.6%	1231	94.8%	67	5.2%	0.198
Do you play any sport?	Yes	1254	60.4%	1192	95.1%	62	4.9%	
	No	822	39.6%	787	95.7%	35	4.3%	0.524

2019. TX).

3. Results

3.1. Description of the surveyed population

3.1.1. Sociodemographic characteristics

The survey was completed by 2086 people, 66% of them were women. The age of more than 40% of the participants ranges between 40 and 54 years. A total of 44% of the respondents have completed university studies. Regarding the home conditions, 72% live in a single-family home, and 26.6% live with 3 relatives in the home. 35% live with children at home and 21% with adolescents, only 4.3% had a housemaid working at their house during confinement, and 4.7% of respondents reported living with a COVID-19 infected household member (Table 1).

3.1.2. Hygiene habits

Table 2 shows that 23% of those surveyed have a dog as a pet, and 19.5% took the dog for a walk during confinement. A total of 47.3% have used surgical masks when leaving home and 65.5% used gloves as a protection element when leaving. Regarding cleaning and disinfection, ethanol was used by 63% of the respondents to clean their hands at home, 77.2% of the respondents used bleach to disinfect the floor of their home, and 64.2% cleaned household doorknobs and surfaces with bleach, 67% of respondents disinfected or isolated footwear when returning home after going outside, and only 37.8% washed the clothes wore when going out, 67.9% of the respondents stated that they disinfect the products they bought when they get home.

3.1.3. Mobility and activities performed during confinement

Only 4.2% of the respondents have used public transport during confinement, the main mean of transport used was bus (2.4%) followed by metro (1.5%). Respondents stated that they had moved to: provision of food and consumer staples (81.8%), pharmacy (67.3%), tobacco shop (19.3%), and bank (20.6%). A total of 56.9% of those surveyed stated that the shopping of basic commodities has been performed once per week. 88.1% of respondents made these purchases in the store and not online, avoiding thus the home delivery service. Only 19.3% of respondents have ordered ready meals for home. Furthermore, 60.5% of the respondents stated that they had used e-commerce to purchase other types of non-essential products. Only 6.2% of those surveyed reported that they have traveled abroad within the 2 weeks prior to confinement. During the period studied, only 28.5% of the respondents went to their workplace, which was performed in enclosed areas in 92% of the cases. A total of 32.8% of the respondents reported that they live with someone who had had to work on-site during this period, performed in 83.7% of the cases in enclosed areas (Table 3).

3.1.4. Comorbidities and habits related to health

Among the surveyed participants, 16.4% were smokers. A total of 25% had a history of previous disease diagnosed prior to the state of alarm, 23.1% were overweight, 37.4% were regularly under pharmacological treatment prior to the pandemic and 60% play sports (Table 4).

3.2. Prevalence of COVID-19

The prevalence of COVID-19 was estimated in 4.7% (99 out of 2086 participants). This percentage includes confirmed cases (n = 49) and people with symptoms compatible with COVID-19 who declared they suspected of having suffered the disease (n = 50).

3.3. Effect of the variables analyzed on the prevalence of COVID-19

3.3.1. Sociodemographic characteristics

Table 1 shows that among all the variables analyzed, those that exerted a statistically significant effect was walking the pet and living with a COVID-19 patient. No differences in estimated prevalence were found based on sex, age, type of residence, the number of people living in the home, living with children or adolescents or having a housemaid working at their home. People who reported walking their pets had a higher estimated prevalence of COVID-19 compared to those who did not take their pet for a walk (6.9% versus 4.2%, respectively).

3.3.2. Hygiene habits

Table 2 shows the effectiveness of the different hygiene measures recommended by the authorities analyzed in this survey. The hygiene habit that had the highest significant effect on the estimated prevalence of the disease was the application of a disinfectant on the products purchased from the market upon arrival home. However, no effect was found that reaches statistical significance to the other hygiene measures, such as using masks, gloves, disinfecting with ethanol or bleach, disinfecting shoes and washing clothes when returning home.

3.3.3. Mobility and activities performed during confinement

The variables studied that had a higher effect increasing the prevalence of COVID-19 were the use of public transport, specifically metro, and working on-site at the workplace during confinement (Table 3). Other activities performed, such as attending the supermarket, pharmacy, medical care center, tobacco shop or bank, the frequency with which basic commodities were purchased, ordering home-delivered meals, the use of e-commerce for non-essential products, having traveled abroad within two weeks before the state of alarm was decreed in Spain, or living with a household member who has been working on-site at the workplace, showed no significant effect on the estimated prevalence of COVID-19 (Table 3).

3.3.4. Comorbidities and habits related to health

Among all the variables studied within this category, shown in Table 4, only smoking had a significant effect on the estimated prevalence of the disease. The other variables, such as suffering from any disease prior to the lockdown, being overweight, having undergone periodic pharmacological treatments prior to the pandemic and playing any sport, showed no significant effect on the estimated prevalence of COVID-19.

3.3.5. Results from multivariate analysis

After adjusted for potential confounding between variables, only walking the pet, living with a COVID-19 patient, applying a disinfectant product on the products purchased from the market upon arrival home, using home delivery service, and working on-site at the workplace showed a significant effect on the risk of COVID-19. Specifically, walking the pet was associated with an increased risk of 78% (95% CI, 1.03 to 3.06), not disinfecting the products increased the risk by 94% (95% CI, 1.18 to 3.19), the purchase of basic products using home delivery service increased the risk by 94% (95% CI, 0.98 to 3.84), and working on-site at the workplace was associated with a 76% higher risk (95% CI, 1.06 to 2.90). Living with a COVID-19 patient was associated with a 60-fold increased risk of contracting the disease (OR = 60.5; 95% CI, 35 to 104) (Table 5).

4. Discussion

Most of the 2086 individuals surveyed in this study were graduate and postgraduate students living with their families. The estimated prevalence of COVID-19 found in our sample was 4.7%. These data are consistent with the results of the ENE-COVID national study, which reinforces the validity of the self-diagnosis and, therefore, the validity of the results described here (https://www.mscbs.gob.es/ciudadanos/ene-covid/docs/ESTUDIO_ENE-COVID19_PRIMERA_RONDA_INFORME_PRELIMINAR.pdf). Among those individuals infected with the virus, 5.6% stated that they had not left at any time during confinement.

Table 5
COVID-19 multivariate risk logistic regression model after backward variable selection procedure.

	Odds Ratio	*p*-value	95% CI
Pet walk			
No	1		
Yes	1.78	0.037	(1.03–3.07)
Disinfection of food products			
Yes	1		
No	1.94	0.009	(1.18–3.19)
Food purchase modality			
On-site	1		
Home delivery	1.94	0.056	(0.98–3.84)
Traveling to the workplace			
No	1		
Yes	1.76	0.028	(1.06–2.90)
Living with a COVID-19 patient			
No	1		
Yes	60.53	<0.001	(35.18–104.15)

5. Sociodemographic characteristics

In this study, no different susceptibility to the virus was found between men and women. Forty-seven countries worldwide have reported official sex-disaggregated data on confirmed cases of COVID-19 by June 11, 2020 (Global Health 50/50. COVID-19 – Global Health 50/50. COVID-19 sex-disaggregated data tracker [Online]. 2020. http://globalhealth5050.org/covid19 [May 24, 2020]). Although some authors speculate with a higher prevalence in men than in women hypothesizing with a possible protective effect of estrogens (Dalpiaz et al., 2015), further studies did not confirm the hypothesis. The prevalence of COVID-19 was higher in men than in women in 17 of these countries, whereas in 23 countries the prevalence was higher in women than in men. In one of the countries the prevalence was similar between both men and women. These data clearly indicate that the disease affects both sexes with a higher or lower prevalence based on other variables. Possibly, sex-prevalence might depend on some sociocultural-related aspects to be investigated in the future.

The present study did not show effect of age on the estimated prevalence of COVID-19. These data are consistent with those reported for Spain by a published study (Natale F., Ghio D., Tarchi D., Goujon A., Conte A. COVID-19 Cases and Case Fatality Rate by age. 2020. European Comission. https://ec.europa.eu/knowledge4policy/publication/covid-19-cases-case-fatality-rate-age_en) in which cases are equally distributed between the age group 20–60 and over 60. This finding was also found for the data about the USA. However, this situation is not similar for other countries. In countries, such as Germany, South Korea, China, and France, the highest prevalence was found in the age range of 20–60. The Netherlands and Italy concentrate most of the reported cases in the group over 60.

In consistency with other studies, our study show that the level of education is not statistically significant in relation to COVID-19 (N. N. Liu et al., 2020). However, in the present study, the group of respondents with vocational education was close to the statistical significance towards maximum estimated prevalence among all the educational levels investigated, probably due to the type of profession they perform and their varying degree of exposure to the virus. This aspect will be explored within this study in a later approach.

In the same way, household size had no effect on the estimated prevalence of COVID, in consistency with data from New York (Borjas, 2020). Some studies have been performed to try to reveal the spread of disease transmission based on age-specific social patterns (Y. Y. Liu et al., 2020). In this sense, our study did not find significant increases in the estimated prevalence of the disease in homes where children or adolescents live, although the effect of living with adolescents seems larger than the effect of living with children, and it is close to statistical significance. Having housemaids at home during confinement did not significantly increase the estimated prevalence of the disease.

Particularly relevant was the finding of a significantly higher estimated prevalence of the disease in the population group that reported having walked the dog during the period of confinement, increasing the risk of contracting the disease by 72% according to the odds ratio. However, owning cats or other types of pets did not lead to a significant effect on the estimated prevalence of the disease. Recently, Goumenou et al. suggested the possibility of transmission through dogs being a contributing factor to the extreme COVID-19 outbreak in North Italy (Goumenou et al., 2020). It has been argued in their editorial paper to Molecular Medicine Reports summarizing that "i) Globally, to date, only 4 dogs have been tested for Covid-19. These dogs had come into contact with infected individuals; ii) dogs have an ACE 2 that functions as a SARS-CoV-2 receptor; iii) dog ACE 2 is similar to human ACE 2; iv) the infection of animals from humans and vice versa is plausible; v) no data are available to confirm or exclude the possibility of such human-to-dog and dog-to-human infection; and vi) precautionary measures for such cases have been proposed from all authorities". The results of the present investigation also warn of a higher contagion among dog owners and this higher prevalence still needs to be elucidated. Considering the low possibility of diagnosis in humans, the possibility of diagnosis in dogs is extremely unlikely. These results point to living with dogs as a strong risk factor for COVID-19 infection. Subsequent studies are needed to determine whether the reason for this intense increase in the risk of SARS-CoV-2 infection is due to cross-infection between humans and dogs or to the concept of dog as a vehicle, increasing exposure to the virus derived from behavior and unhygienic habits of dogs on the streets and their subsequent return home.

The results on the estimated prevalence of the disease in the group of respondents who consider having lived with COVID-19 patients have been highly significant. The estimated prevalence of disease among those who reported not living with people infected with COVID was 2.5%, while in those who do consider that they lived with a COVID-19 affected person, the estimated prevalence was 59%, with an adjusted OR in the multivariate analysis equal to 60.5.

5.1. Hygiene habits

During the first stage of the pandemic, the WHO asserted: "Preventive and mitigation measures are key in both healthcare and community settings. The most effective preventive measures in the community include: a) performing hand hygiene frequently with an alcohol-based hand rub if your hands are not visibly dirty or with soap and water if hands are dirty; b) avoiding touching your eyes, nose and mouth; c) practicing respiratory hygiene by coughing or sneezing into a bent elbow or tissue and then immediately disposing of the tissue; d) wearing a medical mask if you have respiratory symptoms and performing hand hygiene after disposing of the mask; e) maintaining social distance (a minimum of 1 m) from individuals with respiratory symptoms" (WHO, 2020). Guidelines for face masks and gloves for the public are very diverse among governments. The efficacy of its use in the general population for the prevention of the disease is a controversial issue far from consensus. Despite the consistency in the recommendation that symptomatic individuals and those in healthcare settings should use face masks, discrepancies were found among the general public and different community settings. One important reason to discourage widespread use of face masks is to preserve limited supplies for professional use in healthcare settings. Universal face mask use in the community has also been discouraged with the argument that face masks provide no effective protection against coronavirus infection (Feng et al., 2020). WHO and most of the authors agree that social distancing is the most important measure that the public can take to combat the virus, a measure that tends to be minimized due to the false sense of security that masks and gloves confer and self-contamination (COVID-19: Physical distancing, wearing gloves. WHO 2020 https://www.who.int/bangladesh/emergencies/coronavirus-disease-(covid-19)-update/social-dist

ance-wearing-gloves).

Inanimate surfaces have been proposed as a possible via for the transmission of COVID-19. Depending upon the nature of the surface, pH, temperature and relative humidity of the surrounding, virus persistence time varies from 1 to 9 days. The highly risk exposed surface areas need to be cleaned frequently with a suitable disinfectant (Pradhan et al., 2020). Person-to-person transmission contributes a major part to make this infection pandemic. COVID-19 transmission is spread via droplets, cough, contaminated hands/surfaces, etc. However, the prevention of person-to-person transmission can be reduced by frequent washing hands with soap and water or disinfecting hands with an alcohol-based sanitizer as recommended by the WHO. Considering the viral infectivity index, formulation 1 (WHO–I) composed of ethanol (85% v/v), glycerol (0.725% v/v) and hydrogen peroxide (0.125% v/v) shows better antiviral activity than formulation 2 (WHO-II) composed of isopropanol (75% w/w), glycerol (0.725% v/v) and hydrogen peroxide (0.125% v/v). Alcoholic concentration >90% coagulates the microbial proteins instantly. Consequently, the coagulated proteins act as a shield for the rest of the microbial proteins, hence it requires a longer contact time for biocidal responses. A predefined concentration range for ethanol (60–70%) and isopropyl alcohol (70–72%) is preferred as an effective disinfectant/biocidal agent. There are many different hydro-alcoholic hand sanitizer formulas available on the market with variable effectiveness. Misinformation and inadequate choice of an effective product by the population means that the measure may be ineffective in protecting the general population which does not guarantee the effectiveness of the use of these agents as a preventive measure (Pradhan et al., 2020). Transmission through contaminated hands share a major contribution to the spread of COVID-19 infection. A report analyzed that people in the metropolitan city touched their faces and common objects with an average time interval of 3.6 and 3.3 times per hour, respectively. The use of nitrile gloves is preferred over latex gloves because nitrile resist some chemicals, including certain disinfectants such as chlorine (Pradhan et al., 2020).

All these studies are consistent with the results obtained in the present study where the hygiene measures recommended by the authorities, such as the use of gloves, masks, hydroalcoholic formulas, the use of bleach to disinfect household surfaces, or the disinfection of clothing and shoes when returning home show no statistically significant preventive effect. In the case of masks, the results of this study slightly suggest the opposite effect to that of protection, possibly due to misuse of masks by the general population untrained in their use.

The effectiveness of disinfection of the items purchased when arriving home have shown statistical significance in reducing the estimated prevalence of COVID-19 compared to the other hygiene measures analyzed in the present study. Specifically, this measure reduced the risk of contracting the disease by 94% according to the odds ratio.

5.2. Mobility and activities performed during confinement

One of the measures adopted by the different governments has been the closure of public spaces, including public transportation systems. However, the effectiveness of these measures is controversial (Coombes, 2020). Public transport systems may be considered a high-risk environment due to high number of people in a confined space with limited ventilation, no access control to identify potentially sick persons and a variety of common surfaces to touch (ticket machines, handrails, doorknobs, etc.). One of the finding of this study has been that the use of public transport systems (particularly metro) increases the prevalence of the disease, fact that sheds light on the debate on the advisability of closing public transport systems.

Other activities, such as attending markets, banks, pharmacies, medical health centers or tobacco shops have shown no effect on the risk of contracting the virus. Requesting home delivery of ready meals or using e-commerce to purchase non-essential products had no effect either, although the effect of the latter was close to the statistical significance.

The frequency with which the basic commodities have been acquired has not had a significant effect; however, the modality of acquisition of these products has been decisive for the prevalence. The home delivery acquisition of these products compared to the on-site shopping doubled the risk of contracting the disease, according to the odds ratio. These results prove that the hygiene and prevention measures implemented in Spanish supermarkets have been effective, in consistency with the results of the study performed by the Organization of Consumers and Users (OCU) in Spain, which found “total absence” of SARS-CoV-2 in all analyzed products in the supermarkets selected to participate in the study (only the main supermarket chains in the country) (https://www.ocu.org/organizacion/prensa/notas-de-prensa/2020/covidsuperficiealimentos140520). These results would also suggest certain weaknesses in maintaining the hygiene chain in home delivery transportation systems.

No higher estimated prevalence of the disease was found in individuals who traveled abroad within two weeks before confinement was decreed in Spain compared to the other participants. COVID-19 distribution in European countries had followed a similar dynamic than in China, the country where the outbreak was first identified, and has subsequently spread globally and mainly in American countries, such as the United States or Brazil. Thus, on March 15, 2020 (one day after the state of alarm was decreed in Spain (RD 463/2020, 14th March), several cases were reported in 30 countries in the European Union (EU) and the United Kingdom (Kinross et al., 2020). However, the pandemic evolution had different impacts according to the country, Spain or Italy were widely affected. In other countries, such as Sweden or Portugal, the COVID-19 impact was lower. Some authors suggested the role of international traffic in the spread of the virus in a globalized world. Chinazzi et al. suggested that the limitation of international traffic could be the cause of the lesser spread of the virus in Turkey (Chinazzi et al., 2020). In the surveyed population of our study, traveling abroad in the period prior to confinement was not related to the prevalence of the disease.

Stopping on-site work in Spain and other countries has been one of the most controversial measures, with a great impact on the population at very different levels. According to the results of this study, on-site work was a risk factor for the prevalence of the disease (regardless of whether the activity takes place outdoors or indoors), increasing the risk of contagion by 76%.

5.3. Comorbidities and habits related to health

In view of the results obtained in this study, despite smoking seemed to be another of the protective factors on the prevalence of the disease according to the bivariate analysis, the multivariate analysis revealed that this effect was not significant and it could be the result of the existence of some confounding effect. Although at the beginning of the pandemic the protective effect of smoking or nicotine was speculated, subsequent studies deny this protective effect and show that smoking is most likely associated with a rapid progression and adverse outcomes of COVID-19 (Vardavas and Nikitara, 2020). Tobacco smokers have a greater predisposition (1.4-fold) to develop severe symptoms of COVID-19. They often require admission to intensive care units (ICU), alongside concomitant mechanical ventilation; moreover, their death rate is approximately 2.4-fold compared to non-smokers (Engin et al., 2020). Our results do not reveal any significant association between the estimated prevalence of the disease and being overweight. Some studies associate obesity with increased susceptibility to the virus (Misumi et al., 2019), although it does not appear to be the most relevant risk factor for COVID-19 disease. Obesity has been associated with higher in-hospital mortality and, in general, with worse in-hospital outcomes (Palaiodimos et al., 2020; Simonnet et al., 2020).

Furthermore, the scientific literature confirms that certain diseases, such as cardiovascular diseases, cerebrovascular diseases, cancer,

respiratory diseases, or diabetes are risk factors for COVID-19 (Wang et al., 2020). Similarly, there is widespread debate among the scientific community about whether some drugs, such as angiotensin converting enzyme (ACE) inhibitors and angiotensin receptor blockers (ARBs), may increase the susceptibility to the COVID-19 infection or not. In the present study, the estimated prevalence of COVID-19 was compared between the group of respondents having a comorbidity diagnosed prior to the state of alarm and the group without comorbidities. No significant differences were found under this approach. Subsequent analysis of the results will reveal potential associations between the estimated prevalence of COVID-19 and specific pathologies of the surveyed individuals. Similarly, in this first analysis of the results obtained from this study, no effects of chronic pharmacological treatment in general on the estimated prevalence of the disease were detected. In a later analysis, we will analyze the effect of certain types of drugs on the prevalence of COVID-19. Finally, our study does not reveal the existence of any effect of sport practice and physical activity on the prevalence of the disease in any sense (risk or protection).

5.3.1. *Strengths and limitations of the study*

The main limitation of this study is that it is based on a mass online survey, involving the absence of a sampling frame to develop a probability sampling design and the calculation of a response rate. This characteristic led to an overrepresentation of women (66%) and an underrepresentation of the elderly, which makes us suspect that the prevalence obtained is underestimated compared to the real populational data. However, given that the main objective of this research was not so much to provide an accurate estimate on population prevalence, but rather to identify risk factors for catching the disease, this selection bias would have less influence on the main results of the study and its conclusions. The advantage offered by this survey format was the possibility of obtaining a large sample in the shortest possible time interval to give an immediate response to the urgency of the situation.

Another limitation of this study is that half of the cases are based on self-diagnosis for presenting symptoms compatible with COVD-19, but they did not have a medical diagnosis. Probably, the insufficient testing capacity at the time of the survey led to this disadvantage situation. However, there are several reasons suggesting the veracity of these suspected cases: the epidemiological context on the date of the survey with a high incidence of the disease, the population's knowledge of the symptoms and the non-coexistence with a peak of other epidemics with similar symptoms (such as seasonal influenza) during this period. The consistency found between the prevalence estimated from the results obtained in this study and that found in the national study performed by the government of Spain also supports the robustness of this study.

6. Conclusion

The results of this study demonstrate that living with dogs, working on-site, purchasing essential commodities by using home delivery service, and especially, living with a COVID-19 patient, have been the main routes of transmission of SARS-CoV-2 during the most restrictive period of confinement in Spain. In addition, the most effective hygiene measure during this period has been the disinfection of the products purchased upon arrival home, above all other hygiene measures recommended by the authorities.

Credit author statement

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Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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Appendix A. Supplementary data

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